

CLAIMS

What is claimed is:

1. A golf ball comprising:  
a shell;  
a core material which is encased within said shell;  
a tag having a diode which is coupled to an antenna, said antenna having at least a portion formed from an elastic conductive material which is encased within an outer surface of said shell.
2. A golf ball as in claim 1 wherein said elastic conductive material comprises a cured conductive ink which is elastic after curing and wherein said antenna has high durability.
3. A golf ball as in claim 1 wherein said tag has at least a portion disposed between an outer curved surface of said core material and an inner curved surface of said shell, and said tag is designed to receive a radiofrequency (RF) signal of a first frequency and to re-radiate a return RF signal of a second frequency.
4. A golf ball as in claim 1 wherein said tag has at least a portion disposed between an outer curved surface of said core material and an inner curved surface of said shell and wherein said tag is detectable with a handheld transmitting/receiving device over a range of at least 20 feet separating said handheld transmitting/receiving

device and said tag, and wherein said golf ball has high durability and substantially complies with golf ball specifications of the United States Golf Association or the Royal and Ancient Golf Club of St. Andrews.

5. A golf ball as in claim 1 wherein said antenna comprises at least one perforation which extends from a first surface of said antenna to a second surface of said antenna.
6. A golf ball as in claim 1 wherein said core material comprises a void in which at least a portion of said diode is disposed.
7. A golf ball as in claim 1 wherein an outer surface of said core material comprises a template which provides a pattern of said antenna.
8. A golf ball as in claim 7 wherein said template is used to paint said antenna onto said outer surface.
9. A golf ball as in claim 1 wherein said antenna comprises a seed layer and a plated layer which is coupled to said seed layer.
10. A golf ball as in claim 1 wherein said antenna is patterned as a radial transmission line.

11. A golf ball as in claim 1 further comprising a further tag having a further diode which is coupled to a further antenna and wherein said antenna is patterned as a first radial transmission line and said further antenna is patterned as a second radial transmission line which is substantially orthogonal to said first radial transmission line.
12. A golf ball as in claim 1 wherein said elastic conductive material comprises a polymer and metal particles dispersed in said polymer.
13. A golf ball as in claim 1 wherein said diode is coupled to said antenna by at least one compressible, elastic conductor.
14. A golf ball as in claim 1 wherein said tag has an outer surface which has a substantially spherical surface.
15. A golf ball as in claim 1 wherein said antenna comprises an inductive element.
16. A golf ball as in claim 1 wherein said shell surrounds at least one layer which surrounds said core material and wherein said tag is disposed between said at least one layer and said core material.
17. A golf ball as in claim 3 wherein said elastic conductive material comprises a cured conductive ink which is elastic after curing.

18. A golf ball as in claim 17 wherein said second frequency is a harmonic of said first frequency.
19. A golf ball as in claim 4 wherein said elastic conductive material comprises a cured conductive ink which is elastic after curing.
20. A golf ball as in claim 11 wherein said antenna comprises a first inductive element and wherein said further antenna comprises a second inductive element.
21. A golf ball as in claim 4 wherein high durability comprises being able to withstand at least 20 cannon test hits.
22. A golf ball as in claim 4 wherein said golf ball specifications comprise size, weight and flight characteristics.
23. A golf ball as in claim 4 wherein said handheld, when transmitting, complies with regulations of the Federal Communications Commission.
24. A golf ball as in claim 11 wherein said elastic conductive material comprises a polymer and metal particles dispersed in said polymer.

25. A golf ball as in claim 4 wherein said elastic conductive material comprises a polymer and metal particles dispersed in said polymer.
26. A golf ball as in claim 25 further comprising a further tag having a further diode which is coupled to a further antenna and wherein said antenna is patterned as a first radial transmission line and said further antenna is patterned as a second radial transmission line which is substantially orthogonal to said first radial transmission line.
27. A golf ball as in claim 26 wherein said core material comprises a void in which at least a portion of said diode is disposed.
28. A golf ball as in claim 25 wherein said diode is coupled to said antenna by at least one compressible, elastic conductor.
29. A golf ball as in claim 28 wherein said core material comprises a void in which at least a portion of said diode is disposed.
30. A golf ball comprising:  
a ball material;  
a tag which is coupled to said ball material, said tag comprising an antenna  
which has at least a portion formed from an elastic conductive material.

31. A golf ball as in claim 30 wherein said elastic conductive material comprises a cured conductive ink which is elastic after curing.

32. A golf ball as in claim 30 wherein said tag has a curved outer surface and is detectable with a handheld transmitting/receiving device over a range of at least 20 feet separating said handheld transmitting/receiving device and said tag, and wherein said golf ball has high durability and substantially complies with golf ball specifications of the United States Golf Association or the Royal and Ancient Golf Club of St. Andrews.

33. A golf ball as in claim 30 wherein said antenna comprises at least one perforation which extends from a first surface of said antenna to a second surface of said antenna.

34. A golf ball as in claim 30 wherein said ball material comprises a void in which at least a portion of an electrical element is disposed, said electrical element being coupled to said antenna.

35. A golf ball as in claim 30 wherein an outer surface of said ball material comprises a template which provides a pattern for forming said antenna.

36. A golf ball as in claim 35 wherein said template is used to paint said antenna onto said outer surface.

37. A golf ball as in claim 30 wherein said antenna comprises a seed layer and a plated layer which is coupled to said seed layer.

38. A golf ball as in claim 30 further comprising a further tag having a further antenna and wherein said antenna is patterned as a first radial transmission line and said further antenna is patterned as a second radial transmission line which is substantially orthogonal to said first radial transmission line.

39. A golf ball as in claim 38 wherein said antenna comprises a first inductive element and wherein said further antenna comprises a second inductive element.

40. A golf ball comprising:

a shell;

a material which is encased within said shell, said material having a void on an outer surface of said material;

a tag having a diode which is coupled to an antenna, said diode having at least a portion thereof disposed in said void.

41. A golf ball as in claim 40 wherein said antenna has at least a portion disposed between an outer curved surface of said material and an inner curved surface of said shell, and wherein said tag is designed to receive a radiofrequency (RF) signal of a first frequency and to re-radiate a return RF signal of a second frequency.

42. A golf ball as in claim 41 wherein said diode has two conductive leads which face said shell.

43. A golf ball as in claim 41 wherein said tag is detectable with a handheld transmitting/receiving device over a range of at least 20 feet separating said handheld transmitting/receiving device and said tag, and wherein said golf ball has high durability and substantially complies with golf ball specifications of the United States Golf Association.

44. A golf ball as in claim 41 wherein said antenna comprises at least one perforation which extends from a first surface of said antenna to a second surface of said antenna.

45. A golf ball as in claim 41 wherein said outer surface of said material comprises a template for forming said antenna.

46. A golf ball as in claim 41 further comprising a further tag having a further diode which is coupled to a further antenna and wherein said antenna is patterned as a first radial transmission line and said further antenna is patterned as a second radial transmission line which is substantially orthogonal to said first radial transmission line.

47. A golf ball comprising:
  - a ball material having a template;
  - a tag which is coupled to said ball material, said tag comprising an antenna which is formed in a pattern defined at least in part by said template.
48. A golf ball as in claim 47 wherein said template defines at least a portion of a shape of said antenna.
49. A golf ball as in claim 48 wherein said template comprises at least one of a line or groove or protrusion on a surface of said ball material.
50. A golf ball as in claim 49 wherein said template defines a painted border of said antenna.
51. A method of making a golf ball, said method comprising:
  - forming a first member having an outer surface, said first member forming a part of said golf ball;
  - depositing a liquid material which when dried forms at least one antenna which is electrically conductive;
  - forming a second member which surrounds said at least one antenna.
52. A method as in claim 51 further comprising:
  - curing said liquid material;

coupling a diode to said at least one antenna.

53. A method as in claim 51 wherein said at least one antenna is an elastic conductive material and wherein said liquid material is deposited onto said outer surface.

54. A method as in claim 53 wherein said depositing comprises at least one of (a) painting said liquid material; (b) printing said liquid material; (c) jetting said liquid material through a nozzle; and (d) spraying said liquid material.

55. A method as in claim 51 wherein said first member is a core material of said golf ball, said core material having a substantially spherical shape, and said second member is a layer of material which has a circular cross-sectional shape and which encases said first member and said at least one antenna.

56. A method as in claim 55 wherein said second member is an outermost shell of said golf ball.

57. A method as in claim 55 wherein said second member is an inner shell.

58. A method as in claim 53 wherein said elastic conductive material is a conductive ink.

59. A method as in claim 51 further comprising:  
forming a template on said outer surface, said template defining at least a portion of a pattern of said at least one antenna.
60. A method as in claim 51 further comprising:  
forming a void in said outer surface;  
depositing at least a portion of a diode in said void;  
coupling said diode to said at least one antenna.
61. A method as in claim 51 wherein said at least one antenna is patterned as a radial transmission line.
62. A method as in claim 51 wherein said at least one antenna has at least one perforation which extends from a first surface of said at least one antenna to a second surface of said at least one antenna.
63. A method as in claim 51 wherein said at least one antenna comprises an inductive element.
64. A method as in claim 51 wherein said liquid material comprises a solvent, a polymer and metal particles dispersed in said polymer.

65. A method as in claim 51 wherein said at least one antenna is part of a radio frequency tag which can be used to find said golf ball and wherein said golf ball has high durability and substantially complies with golf ball specifications of the United States Golf Association.
66. A method of making a golf ball, said method comprising:
  - forming a first member having an outer surface;
  - forming a void in said outer surface, said outer surface forming at least a portion of a sphere's surface;
  - depositing a diode into at least a portion of said void;
  - coupling said diode to an antenna formed on said outer surface;
  - forming a second member which surrounds said antenna.
67. A method as in claim 66 wherein said diode comprises two conductive connectors which face away from said first member.
68. A method as in claim 66 wherein said diode is coupled to said antenna through an elastic conductive member.
69. A method as in claim 66 wherein said antenna is formed from a liquid material which is dried.
70. A method for making a golf ball, said method comprising:

forming a first member having an outer surface;  
depositing onto said outer surface an elastic conductive material which forms  
an elastic antenna;  
coupling a diode to said elastic antenna;  
forming a second member which surrounds said elastic antenna.

71. A method as in claim 70 wherein said elastic antenna is elastic in substantially all directions.

72. A method as in claim 70 wherein said diode is coupled to said elastic antenna by elastic conductive elements.

73. A method as in claim 70 wherein said elastic conductive material is deposited in a liquid form by at least one of (a) painting said liquid form; (b) plating said liquid form; and (c) jetting said liquid form through a nozzle.

74. A method as in claim 70 wherein said first member is a core material of said golf ball, said core material having a substantially spherical shape, and said second member is a layer of material which has a circular cross-sectional shape and which encases said first member and said elastic antenna.

75. A method as in claim 74 wherein said diode and elastic antenna form a tag which can be used to find said golf ball and wherein said golf ball has high durability

and substantially complies with golf ball specifications of the United States Golf Association.

76. A method as in claim 75 wherein said second member is an outermost shell of said golf ball.

77. A method as in claim 75 wherein said second member is an inner shell.

78. A method as in claim 70 further comprising:  
forming a template on said outer surface, said template defining at least a portion of a pattern of said elastic antenna.

79. A method as in claim 70 further comprising:  
forming a void in said outer surface;  
depositing at least a portion of said diode into said void.

80. A method as in claim 70 where said elastic antenna is patterned as a radial transmission line.

81. A method as in claim 70 wherein said elastic antenna comprises an inductive element.

82. A method as in claim 73 wherein said liquid form comprises a solvent, a polymer and metal particles dispersed in said polymer.
83. A method for making a golf ball, said method comprising:
  - forming a structure for an antenna on a first substrate;
  - forming a first member having an outer surface;
  - transferring said structure from said first substrate to said first member;
  - forming a second member which surrounds said antenna.
84. A method as in claim 83 further comprising:
  - coupling a diode to said antenna after said transferring.
85. A method as in claim 83 further comprising:
  - forming a void in said outer surface;
  - depositing at least a portion of a diode in said void.
86. A method as in claim 85 wherein said diode is coupled to said antenna during said transferring.
87. A method as in claim 83 wherein said antenna is elastic in substantially all directions.

88. A method as in claim 84 wherein said diode is coupled to said antenna by elastic conductive elements.
89. A method as in claim 83 wherein said antenna is patterned as a radial transmission line.
90. A method as in claim 83 wherein said antenna comprises an inductive element.
91. A method as in claim 89 wherein said antenna comprises an inductive element.
92. A method as in claim 83 wherein said first substrate becomes attached to said first member after said transferring.
93. A method as in claim 83 wherein said first substrate is separated from said first member after said transferring.
94. A method as in claim 83 wherein said structure is formed on said first substrate by depositing a liquid material onto said first substrate.
95. A method as in claim 83 wherein said first member is a core material of said golf ball, said core material having a substantially spherical shape, and said second member is a layer of material which has a circular cross-sectional shape and which encases said first member and said antenna.

96. A method as in claim 95 wherein said second member is an outermost shell of said golf ball.

97. A method as in claim 95 wherein said second member is an inner shell.

98. A golf ball comprising:

a ball material;

a tag coupled to said ball material, said tag comprising an electrical component which is coupled to an antenna, wherein said tag has a substantially curved outer surface which substantially conforms to a surface of a sphere and wherein said golf ball has high durability.

99. A golf ball as in claim 98 wherein said golf ball is durably detectable over a range of at least 20 feet and substantially complies with golf ball specifications of the United States Golf Association or the Royal and Ancient Golf Club of St. Andrews.

100. A golf ball as in claim 98 wherein said antenna is elastic.

101. A golf ball as in claim 98 wherein at least a portion of said antenna is elastic.

102. A golf ball as in claim 98 wherein said tag comprises an elastic connection which couples said electrical component to said antenna.

103. A golf ball as in claim 98 wherein said electrical component comprises a diode and said antenna comprises two radial transmission lines.

104. A golf ball as in claim 98 wherein said high durability comprises said golf ball being able to withstand at least 20 cannon test hits which are administered according to golf ball industry standards and wherein said golf ball remains intact after said at least 20 cannon test hits and said tag remains detectable over a range of at least 20 feet after said at least 20 cannon test hits.

105. A golf ball as in claim 98 further comprising:

a further tag coupled to said ball material, said further tag comprising a further electrical component which is coupled to a further antenna, said further tag having an outer surface which substantially conforms to a surface of a sphere, and

wherein said high durability comprises said golf ball being able to withstand at least 20 cannon test hits which are administered according to golf ball industry standards and wherein said golf ball remains intact after said at least 20 cannon test hits, and at least one of said tag and said further tag remains detectable over a range of at least 20 feet after said at least 20 cannon test hits.

106. A golf ball as in claim 98 wherein said antenna is formed at least in part from an elastic conductive ink.

107. A golf ball as in claim 98 wherein said ball material comprises a void in which at least a portion of said electrical component is disposed.

108. A golf ball as in claim 105 wherein said antenna and said further antenna are substantially orthogonally arranged relative to each other.

109. A mold for making a golf ball, said mold comprising:  
a main body which is used in forming at least a portion of a golf ball;  
a surface feature on said main body, said surface feature being used to form at least one of (a) a void in a ball material, said void being designed to receive at least a portion of an electrical component of a tag; or (b) a template which is used to define a pattern of an antenna.

110. A mold as in claim 109 wherein said main body forms about one half of said golf ball, and wherein said mold further comprises:

a further main body which is used in forming another portion of said golf ball;  
and  
a further surface feature on said further main body, said further surface feature being used to form at least one of (a) a further void in said ball material, said further void being designed to receive at least a portion

of a further electrical component of a further tag; or (b) a further template which is used to define a pattern of said antenna or a further antenna.

111. A method of making a golf ball, said method comprising:
  - forming a first member having an outer surface, said first member forming a part of said golf ball;
  - depositing a conductive material which forms at least one antenna, said depositing comprising at least one of (a) jetting a conducting material; (b) vapor depositing a conducting material; (c) sputtering a conducting material; (d) plating a conducting material; and (e) flame spraying a conducting material;
  - forming a second member which surrounds said at least one antenna.
112. A method as in claim 111 further comprising:
  - coupling a diode to said at least one antenna, said diode and said at least one antenna forming a harmonic tag to allow said golf ball to be found.
113. A method as in claim 111 wherein said at least one antenna comprises an elastic conductive material.

114. A method as in claim 111 wherein said depositing comprises said plating and at least one of said jetting, said vapor depositing, said sputtering, and said flame spraying.

115. A method as in claim 111 wherein said first member is a core material of said golf ball, said core material having a substantially spherical shape, and said second member is a layer of material which has a circular cross-sectional shape and which encases said first member and said at least one antenna.

116. A method as in claim 112 further comprising:  
forming a void in said outer surface;  
depositing at least a portion of said diode in said void.

117. A method as in claim 83 wherein said structure comprises a diode which is transferred to said first member.